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Formalization of a Framework for Cultural Translation in Global Collaboration. The case of the Lean Organization

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Abstract

In the present world, it is not rare to see multiple cultures coexist in large global projects spanning multiple geographies. The misunderstandings arising from these cultural differences are responsible for many failures, which are then blamed by each nationality on the others, without trying to understand and address those differences first.
We propose to prepare the ground for the development of culturally aware information systems based on the application of the Hozo ontology to describe this field and the rules that can be applied to correct the understanding of behaviors in one culture by the individuals representing the other cultures, especially when more than two cultures coexist. The American author Erin Meyer has provided a reference model for this, using eight dimensions. The example of Lean will be used to illustrate the approach of creating a common culture that enables employees from all over the world to work together, using a common language, but at the same time highlighting the fundamental task of translating this common language locally in a way that can be understood by each representative of each culture.

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1. Introduction

We propose to prepare the ground for the development of culturally aware information systems based on two aspects, a knowledge engineering formalization and its application to the Lean organization:

For the Knowledge Engineering formalization, we propose to use the Upper Ontology of Culture or UOC[1] as a framework, and to propose the *Culture Map* (CM) ontology to describe this field and the rules that can be applied to translate behaviors in one culture for the individuals representing the other cultures. The model we took for CM has been described by Erin Meyer in her book The Culture Map[2], using eight cultural dimensions:

- Communicating: from Low Context to High Context
- Evaluating: from Direct to Indirect Negative Feedback
- Persuading: from Principles First to Applications First
- Leading: from Egalitarian to Hierarchical
- Deciding: from Consensual to Top Down
- Trusting: from Task-Based to Relationship-Based
- Disagreeing: from Confrontational to Avoiding Confrontation
- Scheduling: from Linear Time to Flexible Time.

For example, if we take the *scheduling* dimension, an individual belonging to one cultural group may be considered as always late by an individual of another group, while this one might be considered as very punctual by a third one, belonging to a cultural group positioned further on the scale towards *flexible time* than he or she is.

The theory of complex systems[3] enables us to consider each individual working on a project as an agent, associated with properties that will vary based on his/her culture. In this context, we believe that a first alignment of the properties of the agents at the project level (creation of a common culture for the project, which can be a compromise between the represented cultures) is mandatory to achieve a good result, though in theory an on line cultural translation of the behaviors would enable to start immediately, without a need to align the cultures.

To show that the latter option will never be practical, let us imagine which mind-boggling exercise it would be to have global project teams arriving to a meeting scheduled at 9:00 am between 8:30 and 10 am and have a system adapting the agenda based on culture to fit the discussion points to the projected arrival time of each member.

Practically, each individual agent will keep their culture as an attribute, and will apply translation in the context of interaction with other members of the team if they can be taught what these differences are.

It can be argued that the global knowledge workers will have developed a global or company culture that is not their culture of origin, but this global culture is too often assumed by multinational corporations to be shared by all when they start a project with a local group that has not been exposed previously to global projects, so it remains important to consider the culture of origin, while taking into account its evolution in time for global workers.

The example of the Lean Organization will be used to illustrate the approach of creating a common culture that enables employees from all over the world to work together, using a common language, The Toyota Way 2001, first publication in English language of the Toyota Way principles and practices, requested by Mr. Fujio Cho, former president of Toyota, as described for example in Extreme Toyota[4], is a clear example of translating these principles and techniques that were first intelligible only to a Japanese population, to the English speaking workforce in North America. The Toyota Production System would never have had the planetary success it has today if the Toyota culture had not been made available to the west, even coining a different term, Lean, starting with The Machine that Changed the World[5]. Working as a vice president of Information Systems at Toyota Motor Europe, covering 53 markets with almost as many different cultures and different languages, the first author has been able to witness first hand that even literature in English language is not enough to percolate to every audience in Europe, and that further cultural translation is needed.

This article is organized as follows: section 2 presents a framework for including Culture in a Smart System for the Lean Organization. Section 3 presents a domain ontology for the strategic dimensions of Culture. Section 4 presents the influence of culture on the Lean Organization. Section 5 presents an experiment to illustrate the concepts practically and section 6 exposes our conclusions and perspectives.

2. A framework for including Culture in a Smart System for the Lean Organization.

As presented in our work[6], the goal of the ComplexLEAN project is to develop a Smart System for the Lean Organization to reproduce the successful implementations of Lean as a complex system.

This Smart System is being developed based on the KREM model[7], where the need of meta-knowledge to steer the execution of smart systems is recommended.

Meta-knowledge is knowledge about domain knowledge, about rules or about experience. This meta-knowledge can take the form of context, culture or protocols to use this knowledge. Context is information that characterizes a situation in relation to interaction among human-beings, applications and their environment, and can be of four types: identity, place, status or time[8]. Culture meta-knowledge tries to take into account the fact that decisions are made differently depending on the country or culture[2]. And finally protocols may include strategies or problem-solving heuristics for the task to be done (for example, in the case of medical diagnosis, the protocols used by physicians change according to the type of symptoms or the suspected illness).

Context has been studied carefully for a long time in areas like knowledge-based systems and ubiquitous systems, either for handling the complex knowledge in a dynamic manner[9,10,11] or to provide smarter human interfaces[8]. However, there is no agreement on a concise definition of context in these areas. Bazire[12], after a thorough revision of works about context, proposed the components of context as the user and the observer involved, as well as the items, the environment, and other related contexts[13]. Examining the use of context in all areas, context helps when detecting semantic relations to provide extra information and correct interpretations for applications

Diverse representations of context exist in different research areas. Mc.Carthy[9] uses a term c representing context, and the formal representation of a proposition p is true in the context c is represented as `ist(c, p)`. As described above Dey[8] defines context as "any information that characterizes a situation" for context-aware applications, while Porzel[13] refers to a context work, where a model of context contains components and the different relations of the components. The components are the user, an item, and the observer in the environment. Relations here include not only the relations between the components, but also the relations to other contexts.

We choose to represent context (and in particular culture context) in the meta-knowledge component of the KREM architecture in a way similar to the one used in Mc.Carthy[9]. An ontology will enable the identification of the context for a certain agent, and this agent will reason with a subset of all the rules in its Rule layer, that will be chosen with the help of the above mentioned predicate `ist`. It is with this goal in mind that we present the Culture Map (CM) ontology in the following sections.

3. A Domain Ontology for the "strategic" dimensions of Culture

3.1. Ontologies for the Cultural Domain

We intend to use here the Upper Ontology of Culture or UOC of Blanchard and Mizoguchi[1] as a core reference ontology, because it is the most comprehensive upper ontology we found to represent the cultural domain, even catering for its inherent complexity by using a specific ontology editor, Hozo*, instead of the better known Protégé† to meet the additional relations that need to be visualized when dealing with the complexity of cultural contexts.

We will present here a new domain ontology called CM (Culture Map) based on the work of Erin Meyer[2], that we will align with the UOC, and finally we will show how the cultural concepts formalized in this way in the Meta-Knowledge layer of the KREM model can be used in practice in the example of Lean, using our HOT Ontology[6] appearing in the Knowledge layer of the KREM model. Cultural aspects in the meta-knowledge layer could also steer the behavior of the agents that is modelled in the Rules layer of the KREM model.

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* http://www.hozo.jp
† http://protege.stanford.edu

3.2. The UOC Ontology

The UOC Ontology introduces the concepts of `Culture`, `Enculturated Agent` and `Enculturated Complex Agent` (`EnCompA`). They are subject to interdependent definitions in the UOC. A culture is seen as an accumulation of elements produced or integrated (endorsed) by a cultural group. A culture cannot exist without the cultural group that created it and, reciprocally, a group cannot be said to be cultural if it does not possess its culture. Hence an EnCompA is defined as the association of a cultural group and its associated culture.

Figure 1 shows the details of the `Culture` concept. The ontologies were developed with the Hozo ontology editor. Hozo shows a screen with two parts: of the taxonomy of the concepts on the left, using is-a relations, and a more detailed view on the right, enabling to show 'p/o' (part of) and 'a/o' (attribute of) relationships. Those attributes are shown with their description, their cardinality, and at the right, the 'class-constraint', being the class of this object (for example, a *culture producer* has the class-constraint *cultural group*, or a *tangible cultural element* has the class-constraint *artifact*). Those class-constraints can come from even higher level ontologies, like Yamato (Yet A More Advanced Top Ontology)[14], like the *artifact* class.

Concerning the taxonomy of the ontology itself, not completely shown here, it shows notions which are relevant to our purpose: a cultural agent has a culture that is birth related, but it can also acquire a culture by commitment. Belonging to the same class of age or social class, being in a similar physical condition (like being blind), and of course belonging to the same company with the same company culture (occupation-related agent) can enable agents to show similar cultural elements even when they are not acquired by birth.

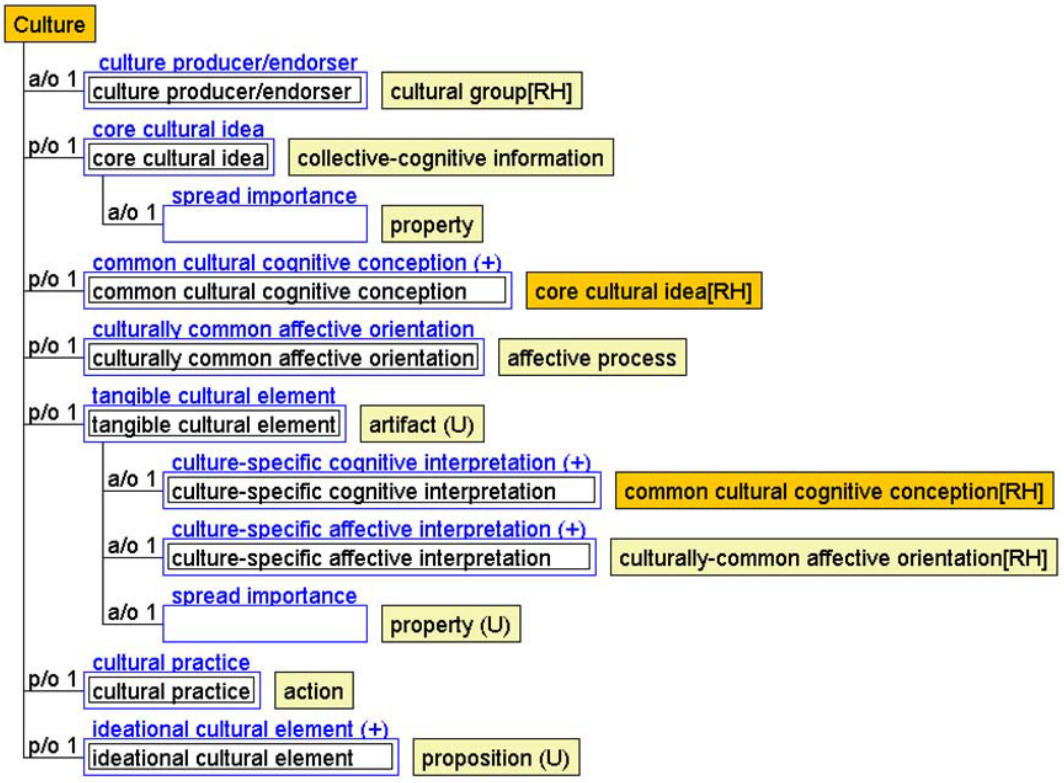

Figure 1 – The `Culture` concept in the Upper Ontology of Culture (UOC)

Then, using some concepts of UOC such as `Culture`, `Enculturated Agent`, `Social enculturated`

`complex agent` (with cultural group, group culture, cultural elements and cultural practices), we can define a domain ontology for culture in the business domain (for example for the management of international projects).

3.3. The Culture Map (CM) Ontology

There have been several works on the formalization of Culture. For example, Geert Hofstede, the Dutch anthropologist, created his cultural dimensions (there are six, the two last ones having been added after his initial research: Power Distance, Individualism, Masculinity, Uncertainty Avoidance, Long Term Orientation and Indulgence[15,16], and it is possible to compare one country to up to two others of these dimensions using a scale of [0..100].

The table below shows an example with the home countries of the two authors, using the site www.Geert-Hofstede.com, and two countries, Argentina and Belgium:

Table 1 - Hofstede's Cultural Dimensions for Argentina and Belgium

Cultural Dimension	Argentina	Belgium
Power Distance	49	65
Individualism	46	75
Masculinity	56	54
Uncertainty Avoidance	86	94
Long Term Orientation	20	82
Indulgence	61	57

More recently, Erin Meyer, in her book The Culture Map[2] has developed a different set of dimensions that she shows to be more appropriate in the context of business relationships which she has been practicing as a Professor at INSEAD Fontainebleau, constantly in touch with students from all over the world, but also in her consulting practice. This is the one we propose to use in this work.

Let us explain shortly what the various dimensions mean:

- Communicating: different cultures communicate differently, based on their cultural heritage and homogeneity/lack of homogeneity. The scale of 0 to 100 goes here from ‘Low Context’, where everything needs to be explained (typical of countries like the USA, where the different waves of immigration from different cultural groups have made it important to start from a low context assumption when communicating, to ‘High Context’ for cultures like the Japanese, where the homogeneity of the cultural group over time enables to assume a high context understanding in communication.
- Evaluating: negative feedback can be given directly (like in the Netherlands) or indirectly (like in Japan)
- Persuading can be done starting with the principles first (like in France) or with the applications first (like in the USA). Not knowing this may ruin the best prepared of presentations by losing the audience from the start.
- Leading goes from Egalitarian (like in the Nordic countries) to Hierarchical (like in Korea)
- Deciding goes from Consensual, like in Japan, to Top Down, like in China
- Trusting goes from Task-Based, like in the USA to Relationship-Based, like in Saudi-Arabia. Task based means that if people work well, the work can be done based on competence only, while in relationship based societies, relationship building is a pre-requisite for a good work relationship – which of course will also need competence, but this will be recognized only after the relationship is built.
- Disagreeing goes from Confrontational, like in Greece to Avoiding Confrontation, like in Indonesia. What this means is that in a confrontational culture, it is ok to express disagreement openly without putting the relationship at stake, while this is not acceptable at all for cultures based on the right side of this scale.
- Scheduling goes from Linear Time like in Switzerland to Flexible Time, like in Nigeria, but with all kind of

relative nuances like in the other examples.

We have formalized this dimensions in the CM ontology (Figure 2 – The CM Ontology in Hozo), showing the particular cultural dimensions and culture that are relevant in business projects involving different cultures.

We created this ontology in Hozo, showing the eight cultural elements, with values from 0 to 100 that are different by country. The cultural groups are shown on the left (using the `Culture` and `Enculturated Agents` notions of the UOC), and the cultural dimensions[2], are shown on the right, each dimension having attributes showing the ranking on that dimension. This enables to compare the different cultures present on a project with a particular dimension.

For example, on a project with French, German, Chinese and Japanese people, the 'communicating' dimension will give: German: 20, French: 65, Chinese: 85 and Japanese: 95, telling us that the context obvious for Japanese people will have to be explained in more detail to match the culture of the Germans, but this is also true of the Chinese towards the French, or the French towards the German.

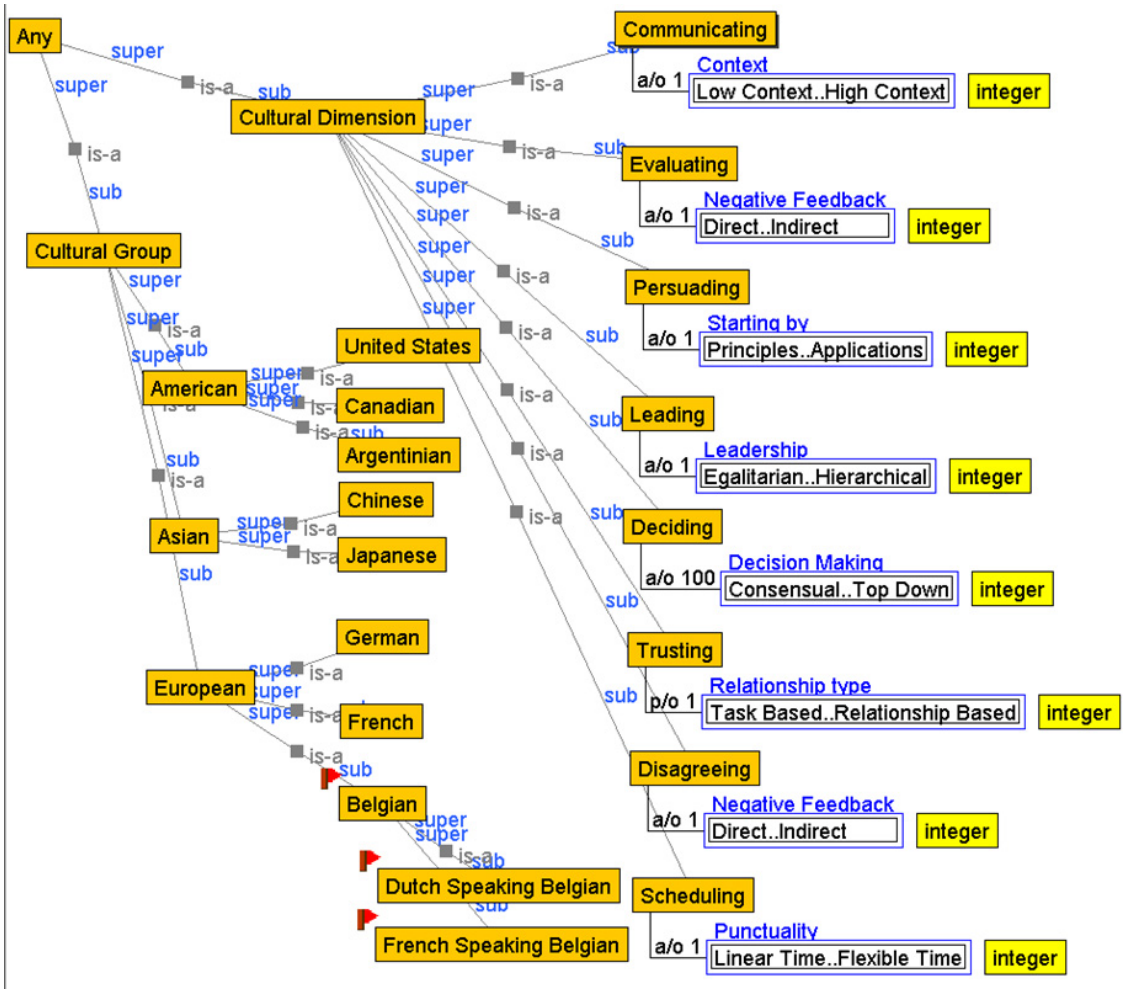

Figure 2 – The CM Ontology in Hozo

4. The Influence of Culture in the Lean Organization

Then, aware of the cultural ontology CM, we describe the Lean concepts with an ontology called HOT, shown on Figure 3 – The HOT (House Of Toyota production system) ontology in Hozo, the concepts of which are explained in more detail in our work presented at KES-2015[6]. As explained before, the CM ontology belongs to the Meta-Knowledge layer of the KREM model, but the HOT ontology appears in the Knowledge layer of the same model. The Meta-Knowledge layer of KREM will steer the behaviour of the entities in the other layers, in particular, in the domain layer. In other words, culture will steer the behaviour of the Lean entities in the domain layer.

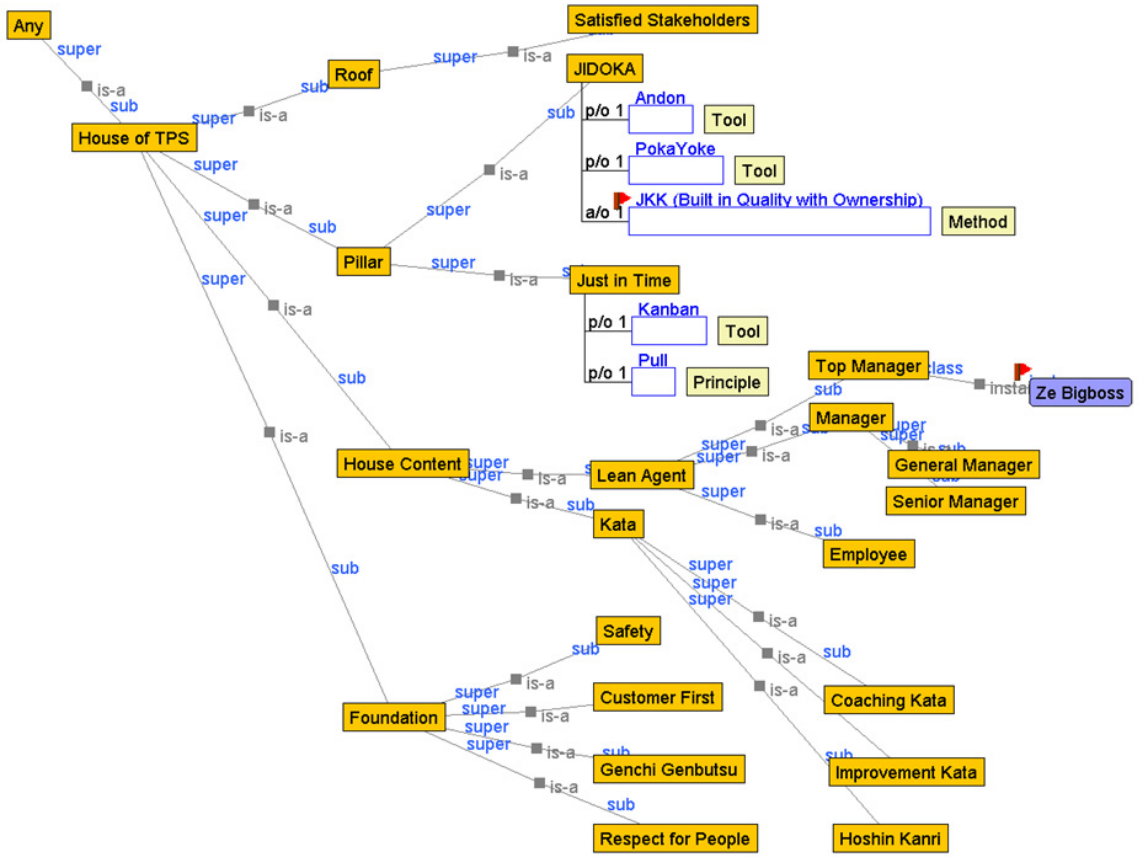

Figure 3 – The HOT (House Of Toyota production system) ontology in Hozo

Let us now explain at a high level the cultural translation needed to first explain the cultural concepts in the CM ontology, then to apply them in a particular culture for each cultural dimension:

`Communicating`. A common language (‘low context’) has to be created within the organization. Visualization and coaching practices (‘coaching *kata*’) are established. These practices and coaching create a common context that can be shared among all cultures, because it becomes an organizational context, rather than a cultural context. In this way, the Japanese culture which is high context and difficult to integrate for foreigners is replaced by a communication context that is common to all the organization workers and facilitates the communication, but that finds its sources at the same time in the deeply engrained Japanese coaching practices (with the well-known concept of *sensei*, or teacher).

`Evaluating`. This is done based on a common standard, but respecting the culture of the employee. Reflection (*hansei*) is systematically encouraged after each project (it is the 'C' or Check phase in the Deming's PDCA cycle). However, different cultures will react differently to this: in some cultures, public reflection after mistakes is expected from children only, while adults are not expected to reflect on mistakes in public, so the reason for this has to be explained better (help others to learn from your own mistakes in order to enable the whole organization to become better at doing things).

`Persuading`. This dimension goes from 'Principles First' to 'Application First'. 'Principles first' is a culture like the French culture, where the principles are normally explained first, then practical examples are used later to illustrate them, while Lean is based on practice, so it is clearly 'Applications First', more like the American culture, where the examples or applications are explained first, and then used to introduce the theory (the principles). This must be considered when teaching Lean to 'principle first' cultures. This is done by explaining the principles and the meaning of Lean to employees before asking them to apply them.

`Leading`. Lean can be applied in both egalitarian and hierarchical models. In an egalitarian culture, this is very natural, because it respects and values the opinion of all those who are knowledgeable in a particular field, and mandates fact based reasoning. When applying it to hierarchical models, it will be essential to train the leader (or 'train the trainer'): the leader will then have the role to mandate the practices that will be followed.

`Deciding`. This dimension goes from 'Bottom Up' to 'Top Down'. Lean is in contradiction with pure 'Top Down'. The *nemawashi* or consensus building practice is obviously a *bottom up* approach, so in *top down* deciding cultures, the consensus building has to be mandated by top management, or it won't happen.

`Trusting`. Lean can be applied in both task based and relationship based cultures. The values of Teamwork and Respect for People will create the relationships needed for both cultures. Relationship building will be encouraged as long as the tasks themselves can be performed with high quality.

`Disagreeing`. In Lean, disagreement is allowed and even encouraged as a way to foster the emergence of new ideas, while respecting basic rules (like not blaming the person). Various options will always be considered before a decision is made. People disagreeing on which solution to take are systematically coached to gather the facts needed to demonstrate the best solution and this helps to strongly reduce the viable options to propose to any top management decision.

`Scheduling`. As mentioned in the introduction, this has to be agreed per site or project. This can be done by clarifying the expectations and the rules. While most cultures understand that being on time for meeting is an acceptable 'compromise', it may not be clear without explanation in a high context culture like Japan that a supplier is expected to arrive at least fifteen minutes before an appointment with his customer to be considered *on time*. Explanation of the cultural context to expatriates is mandatory in such a situation.

Here, it becomes clear that, when teaching the principles of Lean as a common language to different groups of people from different cultures and nationalities, it is important to explain the notions that take their roots in the Japanese culture, like *nemawashi* (very low score on 'Deciding') to cultures high on that scale (more 'Top Down'). But after this is taught and the cultural elements of Lean are integrated by the project teams, it is still important to bear in mind those cultural differences. An example is given above for *hansei* (Reflection, dimension #2), another one is the scheduling (dimension #8), where differences may persist for a long time, so a one off explanation may not be enough (and the way to give the feedback may have to be more or less direct depending on the culture).

5. Experiment

To illustrate the concepts explained here, we propose an experiment, taking the *hoshin kanri* process that we have already described[17], and adding the cultural dimension to it.

5.1. Context of the Experiment

In our work[17], we show the behavior of a typical Lean process, the *hoshin kanri* process (which means 'management of the direction' in the Lean organization), under different starting conditions: do we have the same result if the process starts from a list of potential objectives injected by Top Management, or does it gradually

emerge out of the input of the employees, gradually going up the levels using a consensus building process (called *nemawashi* in Japanese)? We show by simulations that if the operators of the process have good skills and competence, the result can be very good, if not better, when the process is not started by Top Management, but evolves from the positive dynamics of competent agents interacting with each other. Now, imagine that we are in a culture where agents believe they can do only what the manager tells them to do (High Power Distance in the scale of Hofstede, or the `Leading` concept on the *hierarchical* side in the dimensions model of Erin Meyer). In this case, it is easy to imagine that, without appropriate input from the Top Management, nothing would happen. This can be solved by asking Top Management to start the process, but in order to reach the ideal organizational efficiency, it can be achieved by recognizing the cultural context, and asking the Top Manager in this case to give a strong order to all his/her employees to come with individual ideas, reassuring them that he/she will take ultimate responsibility for the result.

5.2. The hoshin kanri process in the cultural context

Let us give a high level description of the standard rules of the *hoshin kanri* process:

- The purpose of *hoshin kanri* is to generate a consensed view of company objectives for the next period (for example one fiscal year for a legal entity)
- The process takes around 90 days (three months)
- The number of items to come up with may be bounded (e.g. max 10 items)
- The process may be started by top management or start bottom-up
- The items proposed at operator level are consensed with peers, then submitted to management, consensed again (including the management ideas), and submitted to top management (including top management ideas).
- Every agent in the organization is allowed to contribute with ideas.
- Agents have seniority and expertise. The probability to see their proposed items accepted in the *nemawashi* process increases with their seniority and expertise.

We have modeled these rules, representing the model without distinction of culture using the Drools rules engine and the Python language. We found as relevant cultural dimensions for the *hoshin kanri* process of Lean:
`Persuading` (dimension #3), `Leading` (#4), `Deciding` (#5) and `Scheduling` (#8).

This leads to the following culture-related rules from the meta-data layer, which all add a step before the execution of the *hoshin kanri* process:

- ∀ `agent`, *if* `culture(agent).persuading` ∈ [0..50] ‘Principles First’
  then add step ‘explain *hoshin kanri* process’
- ∀ `agent`, *if* `culture(agent).leading` ∈ [50..100] ‘Hierarchical’
  then add step ‘top management briefing’ at start
- ∀ `agent`, *if* `culture(agent).deciding` ∈ [50..100] ‘Top Down’
  then add step ‘explain the need for *nemawashi*’

Writing these three rules, we have assumed the existence of a function `culture(agent).dimension`, associated with the `ist` predicate mentioned in Section 2, which returns the positioning of the agent’s culture on a scale of 0 to 100 for the cultural dimension mentioned after the point.

The two next rules are examples of periodical checks that can be added within the execution of the process, and not before the process as in the three rules above:

- *if* `culture(agent).scheduling` ∈ [0..50] ‘Flexible Time’ *then* perform ‘progress check’ weekly
- *if* `culture(agent).leading` ∈ [0..50] ‘Top Down’ ∧ (`team_generated_items` < threshold)
  then perform ‘top management reminder’ weekly

We don’t have the ambition to be exhaustive here, but rather to illustrate how the cultural element can be integrated on top of an existing process, keeping the existing rules and adding new rules when relevant in the current

cultural context. A multicultural model may even consider the culture of each agent and give advice tailored to the distance that is observed between the agent and the agreed cultural dimension positioning for the project.

5.3. High level method to apply culture to a generic process

The example above leads us to the following method to integrate culture in a generic process, taking into account the cultural dimensions from the CM Ontology:

- Detect the relevant dimensions for the process and the culture needed to perform the process in an optimal way.
- For each dimension and agent, add an alignment step upfront if the cultural difference is higher or lower than a given value (for example 50 points on a scale of 100).
- For the execution of the process itself, add mini-steps for some of the dimensions (for example in a *flexible time* culture, more frequent checks of the progress may be needed).

6. Conclusions and perspectives

In conclusion, the cultural context provided by the Upper Ontology for Culture (UOC) and the Culture Map Ontology (CM) delivers a useful framework to enhance knowledge of a particular field, like the Lean domain described by the HOT Lean domain ontology. It enables us to enrich the knowledge and rule models for Lean with experience and meta-knowledge coming from the cultural context. Clarifying the vocabulary and formalizing the interactions that were otherwise often handled in an informal way has provided us a solid basis for future work.

As next steps, we are now implementing a smart system for Lean in different cultural contexts. The description of culture as a separate formal model aligned with the UOC will allow its reuse in other domains. Our operational prototype for *hoshin kanri* has already been experimented in the first quarter of this year in the organization of the first author, and more experiments with other organizations and other Lean processes will follow.

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